

***Rineloricaria isaaci* (Loricariidae: Loricariinae), a new species of loricariid catfish from the Uruguay River basin**

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Rineloricaria isaaci is described from tributaries of the Uruguay River basin in Argentina, Brazil and Uruguay. The new species is distinguished by having a long and wide area of naked skin at the snout tip, surpassing the anteriormost pore of the infraorbital ramus of the sensory canal, approximately in the middle of the third postrostral plate, and by its particular sexual dimorphism characterized by the long pectoral and pelvic fins of mature males.

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Key words: freshwater fishes; Neotropical region; systematics; taxonomy.

INTRODUCTION

Among the Loricariinae, *Rineloricaria* is the most speciose genus, including 60 species currently recognized as valid and a large number of undescribed forms (M. Ghazzi, pers. comm.; I. Fichberg, pers. comm.; per. obs.). The species of *Rineloricaria* inhabit diverse habitats from high mountain streams to large floodplain rivers from southern Costa Rica to northern Argentina (Ferraris, 2003; Rodriguez & Miquelarena, 2005).

In an attempt to shed some light in the complex taxonomy of *Rineloricaria*, Isbrücker *et al.* (2001) split *Rineloricaria* into four phenetic assemblages and provided generic names for them. Based on external characters those authors recognized and re-diagnosed *Rineloricaria* and *Hemiloricaria* and described as new *Fonchiichthys* and *Leliella*. Although these groups are based on external characters only, they are nonetheless useful in breaking *Rineloricaria* into more tractable subgroups. Part of this rearrangement was accepted and maintained by Ferraris (2007), who listed 22 species of *Rineloricaria*, mostly from Argentina and southern and eastern Brazil, 25 species of *Hemiloricaria* and two species of

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Fonchiichthys. The genus *Leliella* was not recognized by Ferraris (2007), who interpreted the only species of this genus as a junior synonym of *Rineloricaria heteroptera* Isbrücker & Nijssen, 1976.

Hemiloricaria is characterized by having an upper, and sometimes lower, caudal-fin rays produced as long filaments; the abdomen completely covered with platelets; males with hypertrophied odontodes dorsally from the interorbital region to the predorsal area, on the snout, and on the pectoral-fin rays. The species of *Rineloricaria* have outer caudal-fin rays not extended into filaments, the abdomen variably covered with platelets, and sexual dimorphism where males present hypertrophied odontodes on the sides of snout and the pectoral-fin rays only (Isbrücker *et al.*, 2001).

The current paper describes a new species of Loricariinae from the Uruguay River basin. Although a phylogenetic revision of the genus *Rineloricaria* is pending, the species is placed in the genus, with which it shares several characters.

MATERIALS AND METHODS

Morphometric variables were measured with digital calipers (0.1 mm precision). Most measurements and counts follow Isbrücker & Nijssen (1978), except counts of lateral abdominal plates (thoracic plates of Isbrücker & Nijssen, 1978; Reis & Pereira, 2000), fused plates and cleithral width, which were taken according to Reis & Pereira (2000). Orbital diameter was measured according to Isbrücker (1973). Names and counts of plate rows and rostral plates follow Schaefer (1997). The definition of rostral border follows Reis & Pereira (2000). The nomenclature for the compound pterotic-supracleithrum follows Schaefer (1987).

Osteological observations were made on specimens cleared and stained (CS) following Taylor & Van Dyke (1985). In the lists of type material, museum abbreviations and catalogue numbers are presented first, followed by the number of specimens examined, number of cleared and stained specimens, and locality. Range of standard length (L_S), geographical co-ordinates, date of collection and collectors are added for the new species. Abbreviations for institutions follow Leviton *et al.* (1985).

The comparative material examined in this study is detailed in the Appendix.

RESULTS

RINELORICARIA ISAACI SP. NOV.

Holotype

MACN-Ict 8969, 106.1 mm L_S , male, Los Loros stream, c. 31°52' S; 58°14' W, Uruguay River, Entre Ríos Province, Argentina, 25 August 1974, Fernández Santos & H. P. Castello (Fig. 1 and Table I).

Paratypes

Entre Ríos Province, Uruguay River basin, Argentina: MLP 9668, 1, 93.4 mm L_S , El Pelado Stream, c. 32°19' S; 58°14' W, 24 June 2005, A. Miquelarena *et al.*; ILPLA 1715, 1 CS, 77.9 mm L_S , same locality and collector as MLP 9668, 1 November 2005; ILPLA 1716, 3, 61.6–101.8 mm L_S , same locality and collector as MLP 9668; ILPLA 1717, 1, 83.3 mm L_S , same data as MLP 9668, 16 November 2005. Rio Grande do Sul, Brazil: MCP 9670, 1, 97.2 mm L_S , road Palmeira das Missões, Panambi, Condor,



FIG. 1. *Rineloricaria isaaci* sp. nov., MACN-Ict 8969, holotype, 106.1 mm standard length, male, Los Loros Stream, Uruguay River, Entre Ríos Province, Argentina.

28°13' S; 53°29' W, 30 September 1982, C. Lucena; MCP 35147, 1, 88.5 mm L_S , Quaraí-Mirim Stream, on road from Quaraí to Baltazar Brum train station, c. 20 km north-east of Quaraí, 30°14' S; 56°18' W, 25 April 2004, R. E. Reis *et al.*; MCP 35255, 1, 95.2 mm L_S , Garupá Stream (creek tributary of Rio Quaraí), on road of Quaraí, Quaraí, 30°9' S; 56°14' W, 25 April 2004, R.E. Reis *et al.*; MCP 40602, 1, 102.0 mm L_S , Quaraí-Mirim Stream, on road between Quaraí and Alegrete, Quaraí, 30°18' S; 56°19' W, 12 November 1986, C. Lucena *et al.* Artigas, Uruguay; MCP 10380, 1, 100.4 mm L_S , Catalán Grande Stream, 30°45' S; 56°10' W, 1 April 1983, E. Gudinas *et al.*

DIAGNOSIS

Rineloricaria isaaci sp. nov. can be distinguished from all other *Rineloricaria* by having a long, naked area along the lateral part of the snout, extending posteriorly beyond the anteriormost pore of the infraorbital canal (v. a very small, round, naked area, or a naked area that does not reach the anteriormost pore of the infraorbital or reaches just to it; Fig. 2). In addition, *R. isaaci* sp. nov. can be separated from all other *Rineloricaria* by having greatly lengthened pectoral and pelvic fins in nuptial males (pectoral fins extend posterior to pelvic-fin origin and pelvic fins extending posterior to anal-fin origin; v. pectorals not extending posterior to pelvic-fin origin and pelvic fins not extending posterior to anal-fin origin; Fig. 3).

TABLE I. Morphometric characters for holotype and paratypes of *Rineloricaria isaaci* sp. nov.

	Hol	Paratypes			
		<i>n</i>	Min	Max	Mean \pm s.d.
L_S (mm)	106.1	11	61.6	102.0	90.7
Per cent of L_S					
Predorsal length	33.1	11	29.3	34.8	31.0 \pm 1.6
Postdorsal length	67.0	11	65.9	71.1	69.3 \pm 1.5
Postanal length	52.5	11	53.6	59.0	56.1 \pm 1.6
Dorsal-fin spine length	21.8	10	19.1	22.0	20.6 \pm 0.8
Anal-fin spine length	17.4	11	14.7	17.8	16.2 \pm 0.9
Pectoral-fin spine length	19.4	11	12.7	18.8	16.1 \pm 1.6
Pelvic-fin spine length	16.8	11	12.5	16.7	15.0 \pm 1.1
Uppermost caudal-fin ray	13.7	11	12.2	16.8	14.4 \pm 1.4
Lowermost caudal-fin ray	14.1	11	11.4	14.5	13.2 \pm 1.0
Thoracic length	17.8	11	14.9	16.9	15.9 \pm 0.6
Abdominal length	16.7	11	14.1	16.8	15.6 \pm 0.9
Cleithral width	20.0	11	14.0	20.2	16.0 \pm 1.8
Depth of caudal peduncle	1.9	11	1.4	1.9	1.6 \pm 0.2
Width of caudal peduncle	3.5	11	2.7	3.8	3.2 \pm 0.3
Body width at dorsal fin	20.6	11	14.3	19.0	16.9 \pm 1.6
Body depth at dorsal fin	12.9	11	9.5	12.4	10.7 \pm 0.9
Body width at anal fin	13.5	11	10.5	13.6	11.8 \pm 0.9
Body depth at anal fin	8.4	11	6.8	8.1	7.3 \pm 0.5
Head length	22.2	11	19.3	24.2	20.6 \pm 1.3
Per cent of head length					
Head depth	55.9	11	43.6	53.1	47.8 \pm 3.2
Snout length	47.1	11	41.8	46.0	44.1 \pm 1.3
Interorbital width	30.8	11	25.8	30.2	27.7 \pm 1.5
Internareal width	9.3	11	7.0	9.4	8.2 \pm 0.7
Orbital diameter, including notch	28.2	11	23.1	27.0	25.5 \pm 1.2
Orbital diameter, excluding notch	17.6	11	15.1	18.6	16.6 \pm 1.1
Premaxillary ramus	10.2	11	8.1	10.2	9.2 \pm 0.7
Dentary ramus	12.9	11	9.7	14.8	10.9 \pm 1.5
Mouth width	56.1	10	35.1	50.3	40.2 \pm 4.2

Hol, holotype; L_S , standard length; Max, maximum; Min, minimum; *n*, number of specimens examined.

DESCRIPTION

Morphometric data given in Table I. Head and body strongly depressed. Trunk and caudal peduncle ventrally flattened and becoming more compressed caudally. Dorsal surface of body slightly convex or straight at snout level, slightly convex at eye level, straight to dorsal fin, straight from dorsal fin to penultimate plate of caudal peduncle. Upper edge of orbit moderately raised. Well-developed triangular postorbital notch.

Profile of head triangular with snout rounded in dorsal view, with straight sides in females and convex in mature males. One pair of rostral plates and four paired postrostral plates present. Postrostral and cheek plates bent

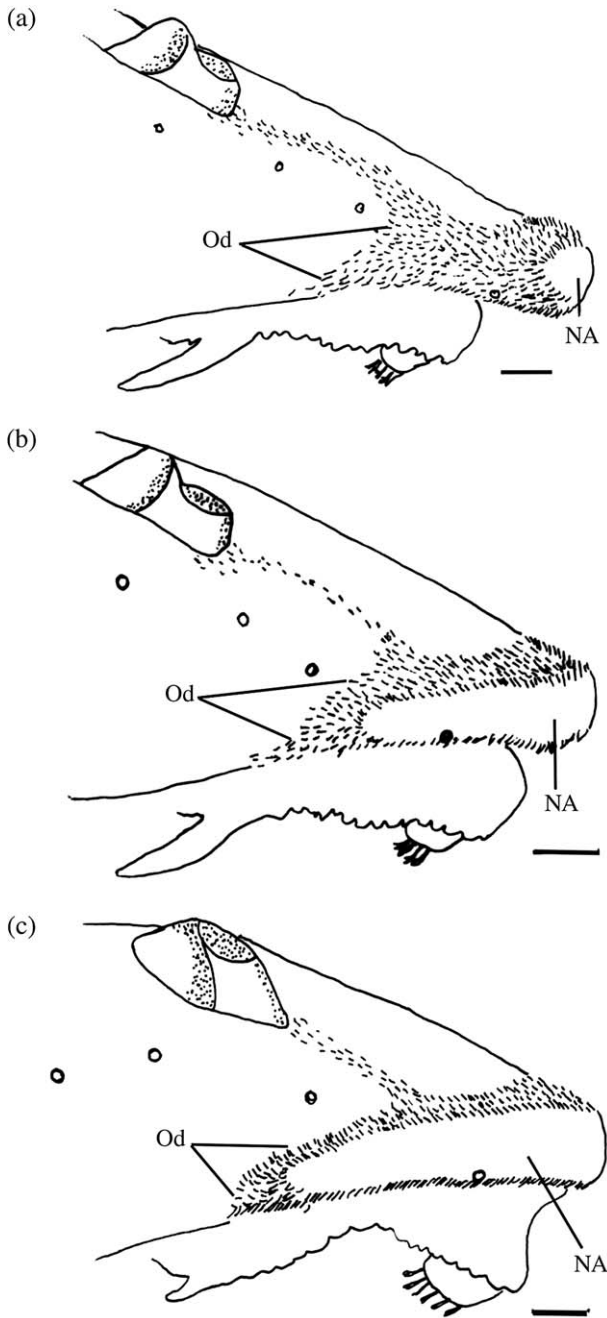


FIG. 2. Naked area of snout in (a) *Rineloricaria quadrensis* and (b) *Rineloricaria longicauda* (modified from Reis, 1983) and (c) *Rineloricaria isaaci* sp. nov. Scale: 1 mm. Od, odontodes; NA, naked area.

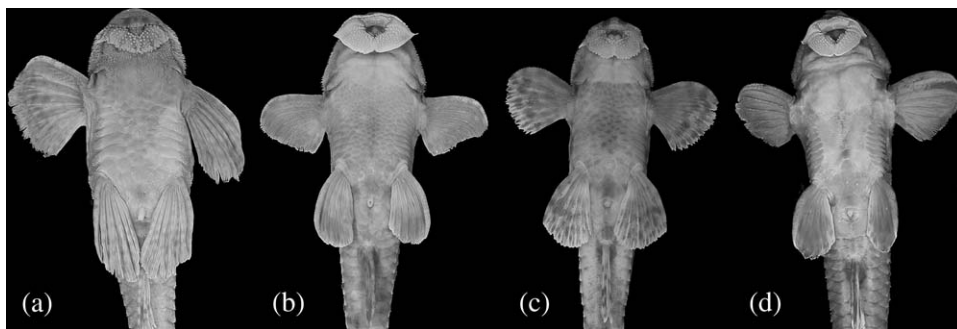


FIG. 3. Sexual dimorphism in pectoral and pelvic fins in mature males of: (a) *Rineloricaria isaaci* sp. nov., MACN-Ict 8969, holotype, 106.1 mm standard length (L_S), (b) *Rineloricaria microlepidogaster*, MCP 34764, 137.4 mm L_S , (c) *Rineloricaria cadeae*, MCP 34728, 98.5 mm L_S and (d) *Rineloricaria aequalicuspis*, MCP 26910, 168.3 mm L_S .

ventrally and visible in ventral view, cheek plate with preopercular canal slightly expanded. Odontodes small, densely arranged in lines covering head, trunk and fin rays, making fish somewhat hispid. Snout tip with elongate area of naked skin (Fig. 2). This naked area surpasses anteriormost pore of infra-orbital ramus of sensory canal, reaching approximately to median of third post-rostral plate (better seen in cleared and stained material). Naked area extending only over rostral and postrostral plates without odontodes, not exposing anterior region of mesethmoid forming rostral border (Fig. 4).

Maxillary barbel shorter than eye diameter. Premaxilla with seven to 10 (mode eight, $n = 12$) bilobed teeth in functional series. Dentary with five to 10 (mode eight, $n = 12$) bilobed teeth in functional series. All teeth with uneven cusps. Mesial cusp longer than lateral one. Six to eight (mode seven, $n = 12$) lateral abdominal plates between origin of pectoral and pelvic fins. Abdomen fully plated except for region of pectoral girdle. Three series of plates between lateral abdominal plates. Many smaller and numerous platelets present between most anterior lateral abdominal plates. Lateral plates 28–30 (mode 29, $n = 12$) with well-developed keels formed by hypertrophied odontodes. Keels coalesced

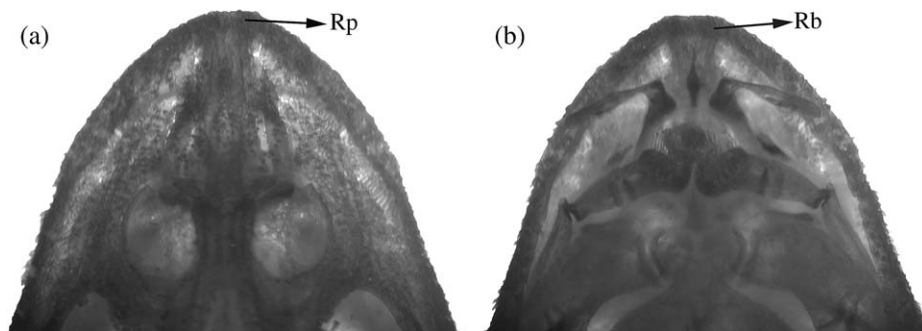


FIG. 4. Detail of the rostral plate (Rp) forming the rostral border (Rb) in *Rineloricaria isaaci* sp. nov. (ILPLA 1715, paratype, 77.9 mm standard length). (a) Dorsal and (b) ventral views.

in last 12–14 (mode 13, $n = 12$) plates. Five lateral series of plates, mid-dorsal, median and mid-ventral with strong keels formed by hypertrophied odontodes; mid-dorsal including four plates.

Supraoccipital bone and predorsal plates with strong ridges. Small area of exposed skin between sphenotic and pterotic-supracleithrum (Fig. 5), seen along whole size range of examined specimens. Supraoccipital posterior process acutely pointed.

Posterior margin of dorsal fin straight, generally with unbranched ray and first or second branched rays longest. Tip of dorsal fin, when depressed, reaching third or fourth plate posterior to last branched ray insertion; reduced dorsal-fin spinelet present in many specimens. Posterior margin of pectoral fin straight or slightly convex, with longer unbranched ray not reaching to or reaching slightly beyond level of pelvic-fin origin (except in mature males). Posterior margin of pelvic fin rounded; first or second branched rays longest, almost reaching to or reaching slightly beyond anal-fin origin (except in mature males). Posterior margin of anal fin rounded, generally with longer first or second branched rays. Tip of anal fin, when depressed, reaching third, fourth or fifth plate posterior to fin insertion; two or three ventral plates along its base. Posterior margin of caudal fin truncate or slightly concave. Unbranched rays not extended as filaments.

COLOURATION

In life, ground colour brown with orange-yellow tones. All fins bright yellow-orange with black spots arranged in bands. Caudal fin with rounded black spot on its base and wide vertical bar near outer margin of fin.

In alcohol, background colour of dorsal surface of head and body brown with six or seven transverse dark brown bars; first bar inconspicuous at



FIG. 5. The small area between the sphenotic (Sp) and the pterotic-supracleithrum (Pt) without plates and odontodes is shown by \Rightarrow (ILPLA 1715, paratype, 77.9 mm standard length). SOC, supraoccipital.

cleithrum, second at origin of dorsal fin, third at end of dorsal-fin base, three or four on caudal peduncle. All fin rays yellowish tan with numerous small dark brown spots arranged in bands, especially in distal third of fins. Caudal fin with conspicuous dark spot on its base and numerous dots close to its outer margin, forming wide black band. Sides of head frequently with dots or vermiculate black spots. Sensory pores with dark pigmentation. Ventral surface yellowish. Snout, upper lip, rostral and postrostral plates in ventral view with black pigmentation.

SEXUAL DIMORPHISM

Males with long hypertrophied odontodes on sides of head and dorsal surface of branched pectoral-fin rays (*c.* 1 to 2 mm in the holotype). Slightly hypertrophied odontodes on rest of dorsal surfaces, especially on head and pre-dorsal region. Odontodes absent in females. The odontodes are not developed as in the species of *Hemiloricaria sensu* Isbrücker *et al.* (2001). Unbranched pectoral-fin ray hypertrophied in males (*v.* females without unbranched pectoral-fin ray hypertrophied). Pectoral fin strongly developed in males, convex, with second branched ray longest, reaching beyond level of pelvic-fin origin. Pectoral fin poorly developed in females, straight or slightly convex, with unbranched ray longest, not reaching or reaching slightly beyond level of pelvic-fin origin. Pelvic fin very long in mature males, surpassing anal-fin origin; third branched ray longest, fourth and fifth rays also very developed (Fig. 6). Pelvic fin short in females, first or second branched rays longest, almost reaching or reaching slightly beyond anal-fin origin. Cusps of premaxillary teeth with smoothly rounded tips in males, sharper and less rounded in females. Sexual dimorphism in shape of tips of teeth is not as conspicuous as in many other species of *Rineloricaria*.

ETYMOLOGY

The specific name *isaaci* was given in honour of Isaác J. H. Isbrücker, for his studies on the family Loricariidae and especially on the subfamily Loricariinae.

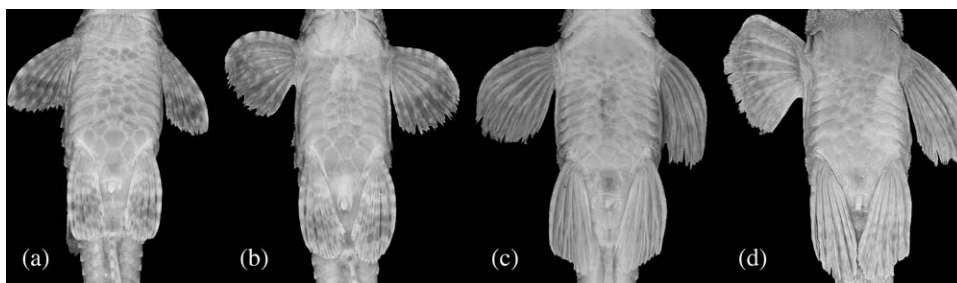


FIG. 6. Sexual dimorphism in the pectoral and pelvic fins in *Rineloricaria isaaci* sp. nov. (a) female, ILPLA 1716, paratype, 101.8 mm standard length (L_S) and different grades of maturity of males: (b) ILPLA 1716, paratype, 96.4 mm L_S , (c) MCP 10380, paratype, 100.4 mm L_S and (d) MACN-Ict 8969, holotype, 106.1 mm L_S .

DISTRIBUTION AND HABITAT

Distributed in tributaries of the Uruguay River drainage (Fig. 7), inhabiting watercourses with clear water, rocky and sandy bottom, with irregularly distributed small stones, cobbles and boulders. One of the tributaries, the Los Loros Stream, has very shallow portions where the stones limit the water flow and deep portions of *c.* 1 m depth. On the other hand, the El Pelado Stream has portions with fast water and up to 600 mm depth, and deeper portions with *c.* 2 m depth and abundant submerged vegetation.

DISCUSSION

After a broad overview of *Rineloricaria* specimens, Rodriguez & Reis (2008) proposed two phenetic assemblages for *Rineloricaria*, based on aspects of their morphology and habitats preferences: the *Rineloricaria* sandy and *Rineloricaria* rocky groups. *Rineloricaria isaaci* sp. nov. present morphological characters of both groups and cannot be placed, exclusively in one of them. On the other hand, the autapomorphic features in the new species (for example: the sexual dimorphism in the pectoral and pelvic fins, the long naked area extending posteriorly beyond the anteriormost pore of the infraorbital canal, and the anterior region of the mesetmoid not exposed, forming rostral border) could indicate that *Rineloricaria isaaci* sp. nov. is a new genus.

A longer pectoral fin in males than in females has been described in many loricariids (Pereira & Reis, 2002; Cardoso, 2004). Within the subfamily Loricariinae, this sexual dimorphism has been recorded in *Farlowella curtirostra* Myers, 1942 (Retzer & Page, 1996) and *Apistoloricaria condei* Isbrücker & Nijssen, 1986. In *Rineloricaria*, males generally have shorter and thicker pectoral-fin spines than females.

The sexual dimorphism described for the pelvic fins is recorded here for the first time for a member of the subfamily Loricariinae. Sexual dimorphism in

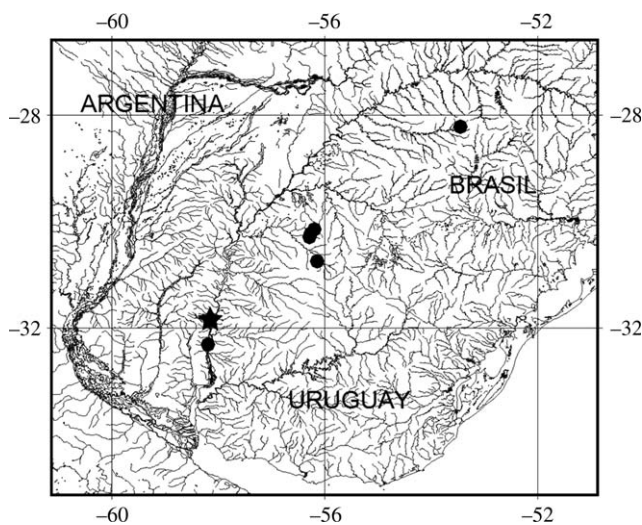


FIG. 7. Geographic distribution of *Rineloricaria isaaci* sp. nov. ★, type locality; ●, paratype locality.

pelvic fin morphology has been described in many species of Loricariidae of the subfamily Neoplecostominae (Pereira & Reis, 2002); Hypoptopomatinae (Britski, 1997; Garavello *et al.*, 1998; Aquino *et al.*, 2001; Britski & Garavello, 2003; Almirón *et al.*, 2006) and members of the tribe Ancistrini in the subfamily Hypostominae (Cardoso & Lucinda, 2003).

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References

- Almirón, A. E., Azpelicueta, M., Casciotta, J. R. & Litz, T. (2006). A new species of *Hisonotus* (Siluriformes, Loricariidae, Otothyrimini) from the República Oriental del Uruguay. *Revue suisse de Zoologie* **113**, 87–94.
- Aquino, A. E., Schaefer, S. A. & Miquelarena, A. M. (2001). A new species of *Hisonotus* (Siluriformes: Loricariidae) of the upper Rio Uruguay basin. *American Museum Novitates* **3333**, 1–12.
- Britski, H. A. (1997). Descrição de um novo gênero de Hypoptopomatinae com duas espécies novas (Siluriformes, Loricariidae). *Papéis Avulsos de Zoologia* **40**, 231–255.
- Britski, H. A. & Garavello, J. C. (2003). *Hisonotus insperatus*: new species, from the upper Rio Paraná basin (Pisces: Ostariophysi: Loricariidae). *Copeia* **2003**, 588–593.
- Cardoso, A. R. (2004). *Hemiancistrus megalopteryx*, a new species of loricariid catfish from the rio Tubarão drainage, Santa Catarina State, Brazil (Teleostei: Siluriformes: Loricariidae). *Ichthyological Explorations of Freshwaters* **15**, 173–178.
- Cardoso, A. R. & Lucinda, P. H. F. (2003). Three new species of *Hemiancistrus* (Teleostei: Siluriformes: Loricariidae) from the rio Tocantins basin with comments on the genus. *Ichthyological Explorations of Freshwaters* **14**, 73–84.
- Ferraris, C. J. Jr (2003). Subfamily Loricariinae (Armored catfishes). In *Checklist of the Freshwater Fishes of South and Central America* (Reis, R. E., Kullander, S. O. & Ferraris, C. J. Jr, eds), pp. 330–350. Porto Alegre: EDIPUCRS.
- Ferraris, C. J. Jr. (2007). Checklist of catfishes, recent and fossil (Osteichthyes: Siluriformes), and catalogue of siluriform primary types. *Zootaxa* **1418**, 1–628.
- Garavello, J. C., Britski, H. A. & Schaefer, S. (1998). Systematics of the genus *Otothyris* Myers 1927, with comments on geographic distribution (Siluriformes: Loricariidae: Hypoptopomatinae). *American Museum Novitates* **3222**, 1–19.
- Isbrücker, I. J. H. (1973). Redescription and figures of the South American mailed catfish *Rineloricaria lanceolata* (Günther, 1868) (Pisces, Siluriformes, Loricariidae). *Beaufortia* **21**, 75–89.
- Isbrücker, I. J. H. & Nijssen, H. (1978). Two new species and a new genus of neotropical mailed catfishes of the subfamily Loricariinae Swainson, 1838 (Pisces, Siluriformes, Loricariidae). *Beaufortia* **27**, 177–206.

- Isbrücker, I. J. H., Seidel, I., Michels, J. P., Schaml, E. & Werner, A. (2001). Diagnose vierzehn neuer Gattungen der Familie Loricariidae Rafinesque, 1815 (Teleostei, Ostariphysi). *DATZ* **2**, 17–24.
- Leviton, A. E., Gibbs, R. H. Jr, Heal, E. & Dawson, C. E. (1985). Standards in herpetology and ichthyology. Part 1. Standard symbolic codes for institutional resource collections in herpetology and ichthyology. *Copeia* **1985**, 802–832.
- Pereira, E. H. L. & Reis, R. E. (2002). Revision of the loricariid genera *Hemipsilichthys* and *Isbrueckerichthys* (Teleostei: Siluriformes), with descriptions of five new species of *Hemipsilichthys*. *Ichthyological Explorations of Freshwater* **13**, 97–146.
- Reis, R. E. (1983). *Rineloricaria longicauda* e *Rineloricaria quadrensis*, duas novas espécies de Loricariinae do sul do Brasil (Pisces, Siluriformes, Loricariidae). *Iheringia, Serie Zoologia* **62**, 61–80.
- Reis, R. E. & Pereira, E. H. L. (2000). Three new species of the loricariid catfish genus *Loricariichthys* (Teleostei: Siluriformes) from southern South America. *Copeia* **2000**, 1029–1047.
- Retzer, M. & Page, L. (1996). Systematics of the stick catfishes *Farlowella* Eigenmann & Eigenmann (Pisces, Loricariidae). *Proceedings of the Academy of Natural Sciences of Philadelphia* **147**, 33–38.
- Rodriguez, M. & Miquelarena, A. (2005). A new species of *Rineloricaria* (Siluriformes: Loricariidae) from the Paraná and Uruguay River basins, Misiones, Argentina. *Zootaxa* **945**, 1–15.
- Rodriguez, M. S. & Reis, R. E. (2008). Taxonomic review of *Rineloricaria* (Loricariidae: Loricariinae) from the Laguna dos Patos drainage, Southern Brazil, with the description of two new species and the recognition of two species groups. *Copeia* **2008**, 333–349.
- Schaefer, S. A. (1987). Osteology of *Hypostomus plecostomus* (Linnaeus), with a phylogenetic analysis of the loricariid subfamilies. *Contributions in Science, Natural History Museum of Los Angeles County* **394**, 1–31.
- Schaefer, S. A. (1997). The Neotropical cascudinhos: systematics and biogeography of the *Otocinclus* catfishes (Siluriformes: Loricariidae). *Proceedings of the Academy of Natural Sciences of Philadelphia* **148**, 1–120.
- Taylor, W. R. & Van Dyke, G. C. (1985). Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. *Cybium* **9**, 107–119.

APPENDIX COMPARATIVE MATERIAL STUDIED

Fonchiichthys rupestris (Schultz, 1944). FMNH 42794, five paratypes, río San Juan, S. of Mene Grande, Maracaibo Basin, Venezuela.

Hemiloricaria altipinnis (Breder, 1925). AMNH 8404, holotype, Rio Chico, Panamá.

Hemiloricaria beni (Pearson, 1924). Bolivia: CAS 28772, holotype and UMMZ 66482, paratype, lago Rogoagua, Rio Beni Basin; AMNH 77365, 3, mouth of Rio Ibarre, Rio Madeira Drainage.

Hemiloricaria formosa (Isbrücker & Nijssen, 1979). FMNH 83713, holotype, lagoon at 1 km upriver from Pto. Inirida, Guainia, Colombia; FMNH 105104, 5, caño Guasuriapana at Guasuriapana, c. 7 min. from S.F. Atabapo, Rio Orinoco Drainage, Amazonas, Venezuela.

Hemiloricaria hoehnei (Miranda Ribeiro, 1912). MNRJ 650, holotype, Rio Paraguai, Coxim, Mato Grosso, Brazil.

Hemiloricaria lanceolata (Günther, 1868). BMNH 1867.6.13.79, holotype, Xeberos, Amazonas superior, Perú.

Hemiloricaria morrowi (Fowler, 1940). ANSP 68663, holotype, Río Ucayali near Contamana, Perú.

Hemiloricaria parva (Boulenger, 1895). BMNH 1895.5.17.91, lectotype (photographs); BMNH 1895.5.17.92-96, 5 and ANSP 53892, 1, paralectotypes (photographs). Descalvados, Mato Grosso, Brazil.

Hemiloricaria phoxocephala (Eigenmann & Eigenmann, 1889), MCZ 8030, lectotype, Coary, Brazil (photographs).

Hemiloricaria sneiderni (Fowler, 1944). ANSP 71433, holotype and ANSP 71434, Choco Province, Colombia.

Hemiloricaria stewarti (Eigenmann, 1909). FMNH 53330, holotype and FMNH 53079, one paratype, Chipoo Creek, Guiana; FMNH 7418, one paratype, Chipoo Creek, between KaraKara and Rupununi, Guiana.

Hemiloricaria wolfei (Fowler, 1940). ANSP 68660, holotype, Río Ucayali basin near Contamana, Peru.

Rineloricaria aequalicuspis Reis & Cardoso, 2001. Rio Grande do Sul, Rio Tramandaí Drainage, Brazil: MCP 13621, 5, Rio Maquiné near Maquine; MCP 14262, three paratypes, Rio Três Forquilhas, on road from Três Forquilhas to Itatí; MCP 26910, 14, 2 CS, Itatí, arroio Carvalho, Santa Catarina.

Rineloricaria cadeae (Hensel, 1868). Rio Grande do Sul, Rio Jacuí Drainage, Brazil: ZMB 7430, lectotype, Picada Café; MCP 8967, 1, Rio Paranhama, Taquara; MCP 9295, 4, arroio Paraiso, Rincão da Porta, Cachoeira do Sul; Rio Camaquã Drainage: MCP 25920, 31, 1 CS, arroio da Mantiqueira, Lavras do Sul; Canal São Gonçalo Drainage: MCP 34728, 98.5 mm L_S , Pedro Osório, Arroio Arambaré, on road from Pedro Osório to Herval.

Rineloricaria catamarcensis (Berg, 1895). MACN-Ict 3585, syntype, arroyo del Tala, Catamarca, Argentina.

Rineloricaria felipponei (Fowler, 1943). ANSP 70324, holotype, Río Santa Lucía, Canelones Department, Uruguay.

Rineloricaria heteroptera. AMNH 74472, 1, Department Rio Negro, Rio Mawarinuma at Cerro de Neblina base camp, Territorio Federal Amazonas, Venezuela.

Rineloricaria jaraguensis (Steindachner, 1909). NMW 44886, one lectotype (photographs); NMW 44882, one paralectotype; NMW 44883, one paralectotype (photographs), and NMW 44884, one paralectotype (photographs), Rio Jaraguá, Brazil.

Rineloricaria latirostris (Boulenger, 1900). BMNH 1899.12.18.6-9 (lectotypes of *L. latirostris* and *L. paulina*) and two paralectotypes, Rio Mogi-Guaçu, c. 25 miles inland from Santos, Brazil.

Rineloricaria longicauda Reis, 1983. Rio Grande do Sul, laguna dos Patos Drainage, Brazil: MZUSP 16078, holotype, west channel of road BR-471, Taim Ecological Station, Rio Grande; MCP 11350, 9, arroio Xasqueiro, on road BR-116 between Pelotas and Jaguarão, Arroio Grande; UFRGS 682, 1 CS, no locality.

Rineloricaria maquinensis Reis & Cardoso, 2001. Rio Grande do Sul, Brazil: MCP 8326, 3, Rio Três Forquilhas, Porto Alagio, Torres; MCP 25817, holotype; MCP 10769, 14 paratypes and MCP 25336, one paratype, arroio Água Parada at Maquiné.

Rineloricaria microlepidogaster (Regan, 1904). Rio Grande do Sul, Rio Jacuí Drainage, Brazil: BMNH 1884.2.5.41, holotype, Rio Grande do Sul; MCP 11202, 11, Rio Caí, on road between São Sebastião do Caí and Bom Princípio; MCP 11220, 26, 2 CS, Rio Cadeia, on road between Caxias do Sul and Porto Alegre; Canal São Gonçalo drainage: MCP 34764, 137.4 mm L_s , Pelotas, Ribeirão Asprezas, on road from Pinheiro Machado to Pelotas.

Rineloricaria misionera. MCP 35793, three paratypes, arroyo Liso, Cuña-Pirú valley, Cainguás Department, Misiones, Argentina.

Rineloricaria pareiacantha (Fowler, 1943). ANSP 67815, holotype, Río Santa Lucía, Canelones Department, Uruguay.

Rineloricaria quadrensis Reis, 1983. Rio Grande do Sul, Brazil: MCP 9548, 4, lagoa dos Quadros, Osório. MCP 10084, 1, mouth of Rio Maquiné into Lagoa dos Quadros, Osório; UFRGS 5638, 2 CS, no locality.

Rineloricaria strigilata (Hensel, 1868). Rio Grande do Sul, Rio Jacuí Drainage, Brazil: ZMB 7429, holotype, Santa Cruz do Sul; MCP 37690, 1 CS, Reservoir Monte Claro, Remanso, Bento Gonçalves; MCP 37691, 1 CS, downstream Reservoir Monte Claro, Veronópolis.

Rineloricaria thrissoceps (Fowler, 1943). ANSP 67796, holotype, Río Santa Lucía, Canelones Department, Uruguay.

Rineloricaria malabarbai (Rodríguez & Reis, 2008). Rio Grande do Sul, Rio Jacuí drainage, Brazil: MCP 9801, paratype, Lageado, arroio Fão; MCP 9843, paratype, Rincão da Porta, arroio Paraíso.

Rineloricaria baliola (Rodríguez & Reis, 2008). Rio Grande do Sul, Rio Jacuí drainage, Brazil: MCP 9565, paratype, Santa Barbara do Sul, Rio Jacuí Mirim at road BR-285; MCP 14602, 17 paratype, Victor Graff, Rio Umbu.